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Exploring Business Value through Information Quality of Collaborative Supply Chain Practices and Performance in Context of Pharmaceutical Industry of Bangladesh

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Abstract

In Bangladesh, Pharmaceutical sector is one of the most developed high-tech sector which is contributing in the country's economy. Nowadays, this sector is providing 95% of the total medicine requirement of the local market. The professional knowledge, collaborative supply chain management practices, thoughts and innovative ideas of the pharmacists working in this sector are the key factors for these developments. Recently, researchers have highlighted the multidimensional nature of collaboration that goes beyond the exchanged of information. Collaborative practices should also incorporate joint decision-making and the alignment of incentives [1, 2]. With regard to information exchanged, the pharmaceutical industry has shared information for many years to arguably an unparalleled level compared with other industries. However, information quality has been largely overlooked by previous research. Research has thus essentially oversimplified the complex nature of supply chain collaboration. There appears to be a gap in the literature acknowledging the multidimensional and complex nature of collaboration and linking it to information quality. This research paper aims to explore the complex nature of collaboration and the role of information quality in the collaboration practices and performance relationship in Bangladesh pharmaceutical industry.

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Specifically, this research focuses on the following research question: does the impact of collaborative practices on operational performance depend on the quality of the information exchanged in terms of its timeliness, accuracy, relevance and added value in context of pharmaceutical industry in Bangladesh. However, the findings suggest that the collaborative practices of information sharing, incentive alignment and joint-decision making do not equally improve performance. In addition, some aspect of collaboration appears to only become important performance drivers if the information exchanged between supply chain partners is of high quality; the quality of information being dependent on its timeliness, accuracy, relevance and added value. Therefore, this study makes a significant contribution to practice by revealing how the specific elements of collaboration impact differently on operational performance. In addition, this work draws particular attention to the practical importance of information quality and its pivotal role for the success of collaboration practice. Specifically, incentive alignment and joint decision-making only significantly improve operational performance when the information is timely, accurate, relevant and adding value, i.e. of high quality. At the same time as information sharing improves operational performance under low and high quality conditions; its impact is significantly stronger when the exchanged information is of high quality. Therefore, to gain the full potential benefits from collaborative initiatives, companies need to priorities investment towards improving the quality of information shared and exchanged between supply chain partners.

Keyword: Business Value; IOS; Supply chain collaboration; Information quality; Incentive alignment.

1. Statement of the problem

In this study, we are investigating whether the information quality and collaborative supply chain practices affect the performance in context of pharmaceutical industry in Bangladesh.

2. Scope and Rationale of the Study

The topic or the study has enough scope of this research because no one in Bangladesh done this study before. And we find out if we do this research it will not also help the Bangladeshi Pharmaceuticals industry also it will help or integrate with other industry like FMCG industry. And also we have enough respondents who were really available in field and they were also cooperative. We also got so many books and references, which really helped us to have a clear idea.

It is perhaps unsurprising that this study in the pharmaceutical industry of Bangladesh confirm that collaborative supply chain practices significantly improve operational performance across the supply chain.

However, the findings suggest that the collaborative practices of information sharing, incentive alignment and joint-decision making do not equally improve performance. In addition, some aspect of collaboration appear to only become important performance drivers if the information exchanged between supply chain partners is of high quality; the quality of information being dependent on its timeliness, accuracy, relevance and added value. Therefore, this study makes a significant contribution to practice by revealing how the specific elements of collaboration impact differently on operational performance. In addition, this work draws particular attention to the practical importance of information quality and its pivotal role for the success of collaboration practice.

Specifically, incentive alignment and joint decision-making only significantly improve operational performance when the information is timely, accurate, relevant and adding value, i.e. of high quality. At the same time as information sharing improves operational performance under low and high quality conditions; its impact is significantly stronger when the exchanged information is of high quality. Therefore, to gain the full potential benefits from collaborative initiatives, companies need to priorities investment towards improving the quality of information shared and exchanged between supply chain partners. Information quality affects many operational aspects and concerns information relating to customer demand signals, orders, logistics status, order tracking, capacity and planning data. The importance of information quality is compounded by the fact that most of it is electronically transferred using inter-organizational systems (IOS) and often automatically. Therefore, the potential for performance being adversely affected by sub-optimal information quality is serious and often invisible. Companies need to realize that unless the exchanged information is of high quality they cannot expect high return from their collaborative initiatives in terms of improved operational performance. However, companies need to acknowledge the multidimensional nature of collaboration and the pivotal role of information quality.

3. Objectives of the study

Research Questions

The following research questions have to be addressed for the study:

1. Does Information sharing affect operational performance when the exchanged information is characterized by high quality compared to low quality information?

2. Does Incentive alignment affect operational performance when the exchanged information is characterized by high quality compared to low quality information?

3. Does Joint decision making affect operational performance when the exchanged information is characterized by high quality compared to low quality information?

Hypotheses

The hypotheses that can be derived from the research questions are:

1. Information sharing has a stronger positive effect on operational performance when the exchanged information is characterized by high quality compared to low quality information.

2. Incentive alignment has a stronger positive effect on operational performance when the exchanged information is characterized by high quality compared to low quality information.

3. Joint decision making has a stronger positive effect on operational performance when the exchanged information is characterized by high quality compared to low quality information.

Development of Conceptual Framework-

The conceptual framework for the proposed study is given below-

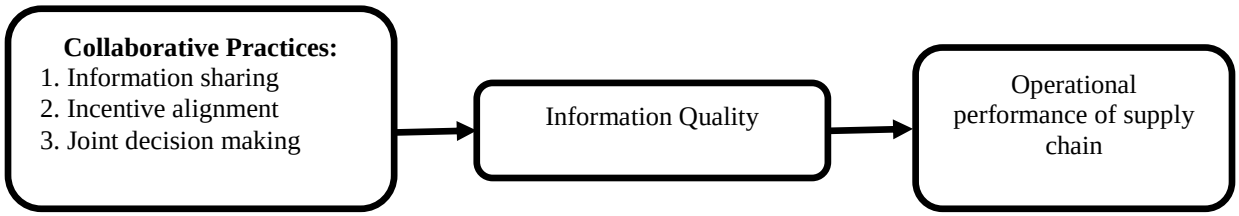

Figure1: The Conceptual Frame Work

4. Methodology of the study

4.1 Research Design

In order to identify the research questions and to test its hypotheses, a **causal research** design has been selected as appropriate for this study. The presentation of the conceptual framework (Figure 1) depicted the pattern and structure of cause-effect relationships among the set of measured variables. The research questions and hypotheses clearly support this model. Hence, the purpose of the study is to measure the causal relationship among the variables.

The present study are investigating the relationship among the factors like information sharing, incentive alignment, joint decision making, information quality, and operational performance of supply chain within the context of pharmaceutical industry in Bangladesh. Here, the operational performance of supply chain is consider as dependent variable and information sharing, incentive alignment, and joint decision making are consider as independent variable. On the other hand, information quality plays a mediating role between the independent and dependent variables. In this study, the researcher is wanted to identify whether any effect exists between these measured variables or not.

4.2 Sampling Method

The required data for this research was collected from the employee at various tiers throughout the supply chain within the pharmaceutical industry of Bangladesh. Since the researcher didn't have any sample frame, so for that the researcher was used the no probability sampling design for this research work. Under the no probability method, the researcher was used the convenience sampling technique to collect the data. Mainly, the researcher had chosen this technique for two reasons. First of all, it is cheaper and finally it is easier to conduct. In this study, the researcher conducted sampling on about twelve Bangladeshi pharmaceutical companies. A total of 163 responses were returned of which 138 were used for subsequently reported analysis.

4.3 Survey Instrument

To gather data, the researcher was used structured questionnaire to identify the extent to which the impact of collaborative practices on firm performance potentially depends on the quality of the exchanged information. For several reasons, the researcher believed that the structured questionnaire will be the best instrument for the survey in this study work. First of all, for a casual study the sample size has to be large since it is quantitative in nature.

Therefore, surveying as many people with personal interview or observation would be next to impossible and time consuming. Secondly, with questionnaire no responses of respondents can be missed out. In addition, it gives more time to respondents to think and give the answer. At the same time, it is a quicker and cheaper way to conduct the survey where it can be conducted in any environment with minimum influence of the outside environment. Moreover, it has the advantage of keeping the personal details of the respondents confidential.

In this case, the researcher was developed the questionnaire in two stages. First of all, the researcher reviewed the all previous research question from the different sources then makes a draft. And then finally, the questionnaire was further refined and finally developed the paper- based structured questionnaire which was used to collect the data. A sample of the questionnaire has been attached in the appendix 1.

4.4 Measures

Collaboration practices are conceptualized as the extent to which organization shares information, costs, risks, benefits and makes joint decisions with its key suppliers. Therefore, it is a multidimensional latent variable that consists of the dimensions joint decision-making, information sharing, and incentive alignment [2]. Information sharing is conceptualized as the breadth of information exchanged in a buyer-supplier relationship [3]. Incentive alignment measures the extent to which the buyer organization share costs, risks, and benefits with its key suppliers [2]. Joint decision-making measures the degree to which buyer the buyer and its key suppliers jointly make key decisions at the strategic planning and operations level [2, 3]. All collaboration practices items were measured on seven point likert scales ranging from one to seven (see appendix 1).

Information quality is conceptualized as the extent to which the exchanged information between the focal organization and its key suppliers is characterized by its accuracy, relevance, timeliness and added value [3, 4]. It was also measured on a seven point likert scale.

An organization's operational performance is conceptualized along the dimensions of costs, quality, flexibility and delivery. They coincide with the four distinct operational performance dimensions [5] and the four basic components a company uses to express its manufacturing strategy measured on a seven likert scale [6,7].

4.5 Data Collection

The data collection was done through both primary and secondary sources. The primary data was collected through questionnaire surveys and the secondary data was collected from the available archive of books, journal, research paper, website and so forth.

4.6 Tests for Non-Response Bias

Before any further analysis can be undertaken, non-response bias is need to test which is the difference in the estimate between the respondents and non-respondents [8]. In order to do so, the significant differences in the responses of early and late returned questionnaires were analyzed [9]. Six of the survey items used in the analysis was randomly selected, and chi-square tested were performed on the initial and last set of 20 responses. The significance values for the selected items were well above the 0.01 level. This indicates that there was no statistically significant difference in the estimate between earlier and later respondents. Therefore, that is no bias for non-response [10].

4.7 Confirmatory Factor Analysis: Validity and Reliability

The relationship between the items and their latent variables are based on the literature, which has been discussed previously. The maximum likelihood method in Lisrel 8.8 was used to carry out the confirmatory factor analysis (CFA). Table II illustrates that the measures of absolute and incremental model fit, and reflect a good fitting measurement model [11, 12].

Table 1: Confirmative Factor Analysis Overall Model Fit-

Model Fit Criterion	Value	Acceptable Range
x2	185.73	N/A
Degrees of freedom (df)	141	N/A
x2 / df	1.32	≤ 2.0
RMSEA	0.046	≤ 0.05
RMSEA 90 per cent conf. interval	(0.025: 0.063)	(0.00: 0.08)
RMR	0.10	≤ 0.10
NNFI	0.98	≥ 0.90
CFI	0.99	≥ 0.90
IFI	0.99	≥ 0.90

Table II provides an overview of the construct measurement items, including their mean, standard deviation, factor loading, t-value, standard error, R2, and coefficient alpha (α). The several development and design stages of the survey instrument, as well as the extensive operations management literature in which each measurement items are grounded assure content validity.

Convergent validity is the degree to which items measure its underlying construct. [12] Suggest testing for convergent validity through evaluating whether the individual item's standardized coefficient from the measurement model is significantly greater, namely greater than twice its standard error. Results in Table III indicate that all of the coefficients of the measurement items exceed twice their standard error indicating convergent validity.

Table 2: CFA Factor Loadings and Reliabilities-

Construct	Variable	Loading	t-value	Standard error	R2
Information quality α = 0.899	Relevance of information for business requirements	0.90	13.70	0.074	0.82
	Added value of information for business	0.82	11.80	0.081	0.67
	Up-to-date and timeliness of information	0.75	10.27	0.090	0.56
	Completeness of information	0.79	11.16	0.0082	0.62
Information sharing α = 0.863	Inventory levels	0.64	9.80	0.11	0.41
	New product development or change in existing products	0.84	12.36	0.10	0.70
	Long-term strategic plan and events	0.89	13.69	0.10	0.90
	Market and economics situations and forecasts	0.81	11.74	0.11	0.66
Incentive alignment α = 0.697	Delivery guarantee for a peak demand	0.61	8.23	0.10	0.40
	Long-term incentive schemes for high standard product quality	0.54	8.57	0.12	0.42
	Agreement on order changes	0.52	8.37	0.12	0.41
Joint decision making α = 0.864	Decision on optimal order quality	0.66	9.87	0.11	0.44
	Decision on new product developments or modifications	0.77	10.81	0.11	0.59
	Decision on long-range planning	0.83	12.08	0.10	0.68
	Decision on forecasting components requirements	0.92	14.18	0.10	0.84
Operational performance α = 0.766	Ordering costs	0.71	8.83	0.093	0.42
	Quality of reliability of procured materials	0.74	8.43	0.10	0.40
	Order cycle time	0.61	0.64	8.93	9.37
	Ability to sense and respond to poor supplier performance	0.073	0.092	0.51	0.55

Discriminate validity measures the extent to which items intended to only measure one latent variable do not at the same time measure a different latent variable [13]. Discriminate validity was tested through inter-factor correlation [12]. Very high inter-factor correlation indicates that the factors are measuring the same concept. Results in Table IV indicate that discriminate validity.

Table 3: Inter-factor correlations

	(1)	(2)	(3)	(4)	(5)
Inform. quality (1)	*0.809*				
Inform. sharing (2)	0.507	*0.738*			
Incentive alignment (3)	0.145	0.263	*0.537*		
Joint decision making (4)	0.130	0.284	0.525	*0.738*	
Performance (5)	0.474	0.528	0.317	0.150	*0.699*

Note: The lower-triangular matrix displays the construct correlations;

Square-root AVE of the corresponding construct is displayed in the diagonal (italics)

An additional more stringent test for discriminate validity is to test for acceptable levels of average variance extracted (AVE). AVE is calculated as the square-root of the average communality [14]. Discriminate validity through AVE in Table IV is also confirmed since the square-root of the AVE for each construct is greater than all over cross-correlations.

Finally, coefficient alpha (α) has been used to test for the reliability (internal consistency). The coefficient's alpha values listed in Table III are closed to or above the commonly expected level of 0.70 which indicates that reliability is relatively high.

5. Review of Related Literature

5.1 Supply Chain Collaboration

Supply chain collaboration has attracted research initiatives from many management fields such as marketing and strategic management and it is therefore conceptualized and define in many different forms such as integration, coordination and simply information sharing. Table 1 (see appendix) provides an overview of the different perspective taken on buyer-supplier relationships and integration from the management literature.

In the supply chain literature, the terms collaboration and integration are related and often used interchangeably [15]. Most noticeably collaboration is viewed as a key component of integration [16, 17, 18, 19]. Reference [16] define integration as the process of interdepartmental interaction and collaboration, bringing together departments to form a unified organization. Reference [17] identified three perspectives of integration: a series of interactions, collaborative behavior, or a composite of the two.

Furthermore, collaboration can be conceptualized as external, i.e. between people and departments, i.e. between organizations and internal [20]. Reference [18] for example, carried out a series of case studies to explore factors that enable and inhibit internal integration among operations, purchasing and logistics. Reference [21]

developed the "arcs of integration" framework that distinguishes between different levels of integration, ranging from extensive supplier integration to extensive customer integration. Their framework has been well cited in the literature [22, 23, 24]. To assess the effect of supply chain integration on the relationship between diversification and performance, Reference [22] built on [21] framework, and developed a three level concept of supply chain integration. They show the integration with suppliers, internal integration across the supply chain and a company's integration with customers. Similarly, Reference [25] adopted the concept of integration to develop the measurement for supply chain collaboration. They investigated supply chain collaboration from both supplier and customer perspectives. To measure collaboration, they employed multiple measures that assess the level of adoption of information exchange and structural collaboration practice.

Whilst focusing on external supply chain relationships in general and collaboration in particular, some common themes can be identified from previous literature (see Table 1). Most noticeable and unsurprisingly find out that collaboration always includes some form of information sharing [26, 27, 28]. In addition, researchers have started to conceptualize the collaboration by linking it to relationship building activities such as incentive alignment and decision-making [2, 27, 28]. Recently, some authors have defined collaboration as a multidimensional concept which should be reflected in the measurement items also [1]. However, only few studies have conceptualized supply chain collaboration as the empirical measure of the extent to which organization collaborate multi-dimensionally. Reference [2] collaboration index seems to be the most comprehensive measure for supply chain collaboration. Their index measures the collaboration in terms of information sharing, decision synchronization, and incentive alignment. Information sharing is conceptualized as the act of capturing and disseminating timely and relevant information for decision makers to plan and control the supply chain operations. Meanwhile, decision synchronization refers to joint decision-making in planning and operational context and incentive alignment refers to the degree to which supply chain members share costs, risks and benefits. This research paper adapts [1,2] approach by measuring supply chain collaboration in terms of information sharing, incentive alignment and joint decision or synchronization practices.

It is generally accepted in the literature that higher degrees of integration and collaboration lead to improve the performance [2, 21,29]. Tight integration and collaboration within and between organizations can lead to an increase in performance [30]. Conversely, a lack of integration and collaboration is problematic [30, 31]. The bullwhip effect as a result of a lack of coordination is the classical example and integration and collaboration has shown to dampen its effect [31]. However, there seems to be a trend in the literature that the more recent research which acknowledges a more complex role of collaboration has shown more mixed results. Reference [19] identified that whilst intra-firm collaboration is found to directly impact on performance, inter-firm collaboration seems to do only indirectly through intra- organizational collaboration. Similarly, Reference [17] carried out an empirical study to assess the effect of internal and external collaboration on logistical service performance. They found supporting evidence that internal collaboration improves the logistical service performance whereas external collaboration does not. Another study by identified that collaboration only marginally improves rates of performance improvement.

5.2 Supply chain collaboration and information quality

The previous review of supply chain collaboration concepts and definitions has highlighted that collaboration and related practices always contain some form of information sharing. Since supply collaboration is practiced through various forms of information exchange. So the success of collaborative supply chain is likely to depend on characteristics of the exchanged information such as quality [32] . Although a few studies have identified that poor information quality can have a negative impact on supply chain performances and its specific impact on the success of collaboration supply chain practices has not been well established to date [33,34].

According to [35], only a limited number of studies have measured the effect of information quality on process or firm performance in operations management. This lack of empirical information quality research might be due to a deficit in measuring constructs. In a study, examining the information quality in order fulfillment processes,[35] carried out a literature review on information quality measurement concepts. She could only identify very few empirical studies related to information quality and subsequently developed new measures for information quality. Reference [35] conceptualized information quality in terms of accuracy, convenience of access and the reliability of information. A recent study by [36] assessed the role of information quality in manufacturing planning and control processes through case examples. Reference [36] identified and defined dimensions for describing information deficiencies. However, they did not assess resulting effects of information quality deficiencies. Using the concept of absorptive capacity in the supply chain context, assessed the mediating role of information quality between information sharing and knowledge creation & operational efficiency. Through cluster analysis, they characterized various types of supply chain partnerships. Besides others they identified a cluster called collaborative supply chain partnership which they propose, has the potential to achieve high operational efficiency and knowledge creation. According to [32], companies in this cluster are characterized by exchanging a broad range of strategic information that is of high quality. Similarly, [33] identified that companies who invest in enhancing the level of information quality gain superior operational performance in terms of supply chain flexibility. Another study by [37] investigated the importance of communication behavior such as information quality for the success of supplier alliance. Their study showed that accuracy, timelines & adequacy, and credibility of information have a positive impact on supplier alliance success aspect such as satisfaction, price, quality, cycle time, technology and new product development time. Using modeling techniques, Reference [34] explored the critical role of information quality for the success of efficient and responsive supply chains. He identified that, amongst other factors, poor information quality results in increased inventory, an increase in total costs and a degrading of customer service due to missing and delayed orders. In a more recent study, Reference [38] explored the characteristics of product information in supply chains. Besides other factors, they highlighted that poor information or product data quality has negative impacts on the benefits potentially gained through collaboration. To conclude, the previous research has convincingly established that information quality affects certain measures of operational performance. However, an extensive empirical investigation of the importance of information quality for the success of collaboration supply chain practices remains to be carried out [38]. In linking the sparse literature on information quality and performance with the collaboration literature it concludes that since information plays such an important part in collaborative supply chains, its quality might also be of vital importance for the success of collaborative supply chains [32]. Specifically, drawing upon [2] coherent concept of supply chain collaboration, in this paper the

researcher argues that information sharing, incentive alignment and joint decision-making may have a stronger impact on operational performance in environments characterized by high levels of information quality as opposed to a weaker impact in low information quality environments. Therefore, in this research paper, the researcher decomposes supply chain collaboration into its three practices and links their impact to operational performance while testing for the importance of information quality.

6. Analysis and Interpretation of the Data

The researcher carried out a series of ordinary least square (OLS) regression analysis to explore the research question in identifying the extent to which information quality impacts upon the collaboration practices and performance relationship. However, prior to carrying out the analysis, the researcher examined the data to test for linearity and multicolinearity [39]. Linearity and quality of variable were assessed and confirmed through plotting the standardized residuals against the standardized predicted value. In order to test for multicolinearity, the approach by [40] was followed. Firstly, the variance inflation factors (VIFs) were calculated and analyzed to detect any possible threats (see Table V & VI). Results indicate that VIFs are below 2 which is indicating that multi co linearity was not of major concern in this research data. Secondly, the condition indices were calculated (see Table V & VI). As a rule of thumb, multicolinearity is a concern if the condition number is 15 and of serious concern if it is greater than 30. Results indicate that the condition indices are also within the desirable range. Therefore, the researcher concludes that based on these tests multicolinearity is not imposing any serious threats to our regression analysis. Since the researcher, sought compare the effects of collaborative practices on performance for companies exchanging high and low quality information throughout their supply chain, the researcher removed responses who rated their information quality as medium from the analysis. The researcher followed the commonly used procedure in splitting the sample into low and high subgroups using the top and bottom 30 per cent cut-off criteria [24]. Table VII provides an overview of the descriptive statistics of the split and reduced sample.

Table 4: OLS Regression Results - Low information quality

Low information quality				
Variable	Standard. Beta Coefficient	t-value	sign	VIF/Cond. Number
Independent variables				
Information sharing	0.356	2.997	0.004	1.116/6.597
Incentive alignment	0.204	1.430	0.158	1.610/12.447
Joint decision making	0.108	0.790	0.433	1.494/3.606
Control variables				
Firm size	0.098	0.832	0.409	1.092/2.435
Note: Low information quality: F (4) = 4.053, p = 0.005; adj. R2 = 0.154; Chow test: F= 3.001 (4, 126) sign. at 0.05 (2.443)				

Table 5: OLS Regression Results - High information quality

High information quality				
Variable	Standard. Beta Coefficient	t-value	sign	VIF/Cond. Number
Independent variables				
Information sharing	0.463	4.170	0.000	1.066/7.884
Incentive alignment	0.513	3.002	0.004	1.533/13.217
Joint decision making	0.362	2.081	0.042	1.623/3.365
Control variables				
Firm size	-0.005	-0.049	0.961	1.037/2.073
Note: High information quality: F (4) = 6.399, p = 0.000; adj. R2 = 0.249; Chow test: F= 3.001 (4, 126) sign. at 0.05 (2.443)				

Table 6: High/low-risk level sample descriptive

	Low information quality		High information quality	
Variable	Mean	SD	Mean	SD
Information quality	3.74	0.650	5.52	0.5249
Information sharing	3.16	1.094	4.70	1.197
Incentive alignment	3.52	1.990	4.09	1.921
Joint decision making	4.63	2.107	4.13	2.095
Performance	4.39	0.9422	5.24	0.9400

The regression analysis was carried out two steps. In the first step the researcher entered the control variable company size, measured by the total number of employees.

Through introducing company size as the control variable, the researcher wants to test whether the results are consistent across company sizes. In the second step, the researcher added information sharing, incentive alignment and joint decision making as the independent variables using operational performance as the dependent variable. Table V & VI displays the results of the OLS regression analysis.

Highlighted cells indicate significant results. Results regarding the control variable of this study indicate that company size did not significantly impact on operational performance.

7. Findings of the Study

After analysis and interpretation of the Data to our objective we find that the hypotheses is getting related to our objective in the foiling way -

- H1 proposed that information sharing has a stronger positive effect on operational performance when the exchanged information characterized by high quality compared to low quality information. Initial results in Table V &VI indicate that information sharing positively affect operational performance in the low information quality sample ($\beta = 0.356$; $p < 0.005$) and in the high information quality sample ($\beta = 0.463$; $p < 0.001$), whether information sharing has a significant stronger impact on performance when information quality is high as opposed to low was tested through a Chow test [41].

The Chow test compares the extent to which the sum of the squared errors (SSE) for the people ample differs from the SSE of the two subgroups [24]. Results indicate that the F-statistics Chow value of 3.001 is above the observed F (4, 126) value of 2.44359. Therefore, there was a significant difference between the regression coefficients in the two samples. Subsequently, hypothesis 1 is supported; information sharing had a stronger impact when the exchanged information was characterized as being of high quality.

- For H2, the researcher hypothesized the impact of incentive alignment on operational performance to be stronger when information quality was high as opposed to low.

Results supported this hypothesis and showing that incentive alignment did not significantly improve operational performance in the low information quality subsample ($\beta = 0.204$; $p = 0.158$) but did in the high quality information subsample ($\beta = 0.513$; $p < 0.05$).

- Finally, in H3 the researcher hypothesized the impact of joint decision making on operational performance to be stronger when information quality high as opposed to low.

Results also supported this hypothesis whereby joint decision making did not significantly improve operational performance in the low information quality subsample ($\beta = 0.108$; $p = 0.433$), but did in the high quality information subsample ($\beta = 0.362$; $p < 0.05$). Therefore, results of the analysis support all three hypotheses.

From the study and findings a conceptual framework can be developed which is as follows:

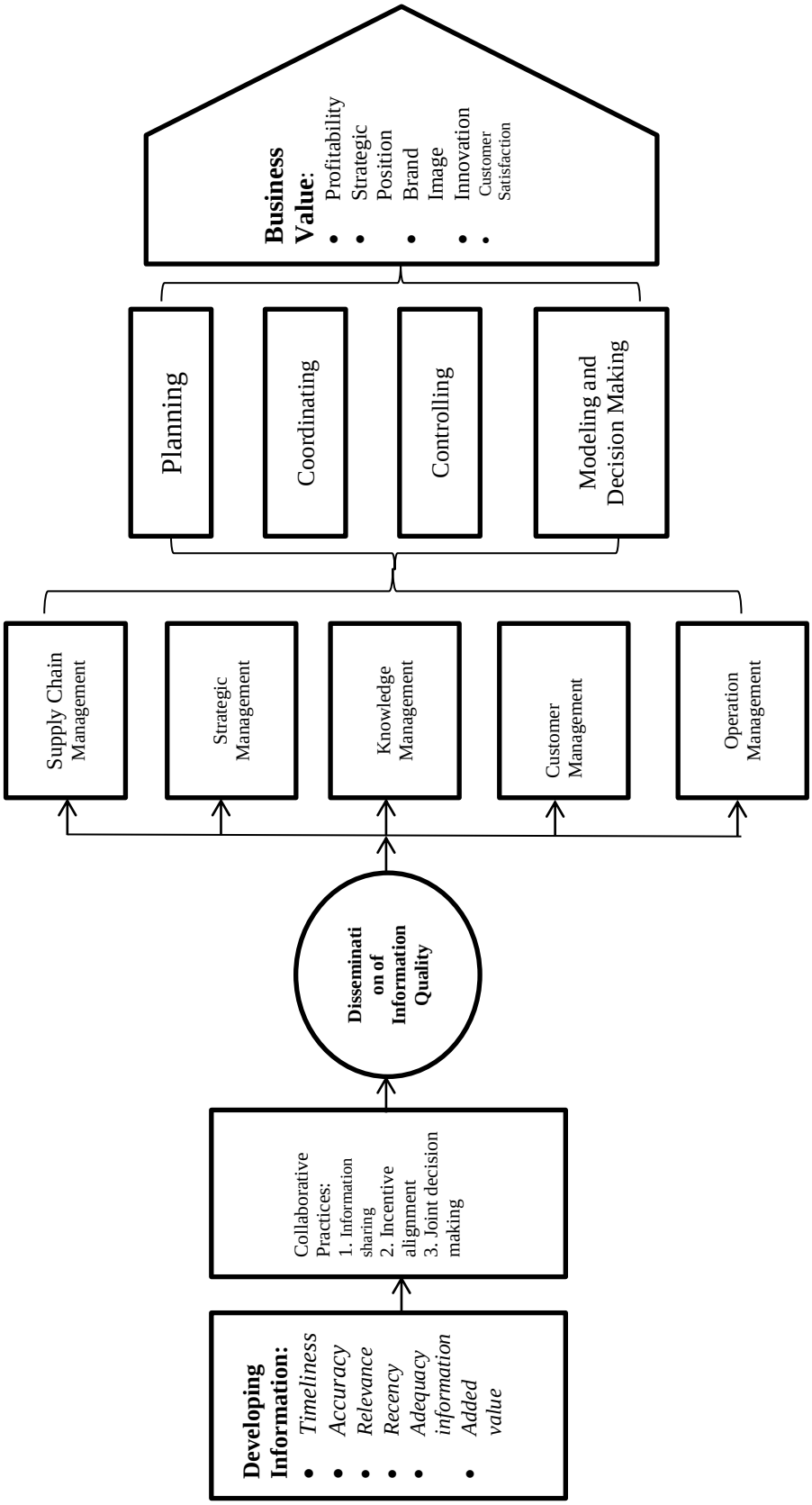

Figure 2

8. Recommendations

Since, in this paper the researcher conducted data from one side of the supply chain, so results could be potentially biased. In addition, collaboration is a concept including at least two supply chain partners. Therefore, the researcher recommends that future research could measure collaboration through data collected from both buyer and supplier. On the other side, this study provides several directions for potential future research in supply chain management in general and collaboration in particular. The results of this paper are based on the data collected from the Bangladesh pharmaceutical industry. To further test and confirm the importance of collaborative practices and information quality for operational performance, the researcher believe that future research could apply the model of this study into different settings and industries. Additionally, information quality might only be one important contextual factor influencing the impact of collaboration on performance. Other factors such as inter-organizational trust and environmental turbulence might also be of important. Therefore, the researcher suggest the continues research efforts are required in order to gain further insights and understandings into how organization can increase the efficacy of collaborative supply chain practices and to understand the complexity nature of collaborative supply chain

9. Conclusion

To conclude, this research has confirmed that collaboration in supply chain of the Bangladesh pharmaceutical industry is multidimensional and involves information sharing, incentive alignment and joint decision-making, and provides additional evidence of the complexity of supply chain collaboration that should be acknowledged in future research efforts on collaborative supply chain practices. In addition, this research has highlighted the very significant impact that the quality of information in terms of timeliness, accuracy, and relevance and value-added has on information sharing and collaborative performance.

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Appendix

The Questionnaire for Collaborative Supply Chain Practices and Performance

Age _____ Years: _____ Female □ Male □

Designation: _____

Please carefully read each descriptive statement, thinking in terms of your opinion about supply chain practices and performance.

Please circle the number, which most closely responds to your thinking.

Information Sharing

Please indicate the extent to which you share the following information with your key suppliers.

Table 7

1	2	3	4	5	6	7
Not at all	Not very	Somewhat Infrequently	Neither Frequently Nor Infrequently	Somewhat Frequently	Frequently	Very frequently

1. Information about inventory levels with your key suppliers	1	2	3	4	5	6	7
2. Information about new product development or changes in existing products with your key suppliers.	1	2	3	4	5	6	7
3. Information about long-term strategic plans and events, e.g. entering new markets, or acquiring a new customer base with your key suppliers.	1	2	3	4	5	6	7
4. Information about market and economic situations and forecast with your key suppliers.	1	2	3	4	5	6	7

Incentive alignment

Please indicate the extent to which your organization shares costs, risks and benefits with your key suppliers.

Table 8

1	2	3	4	5	6	7
Minimum level	Least level	Least likely level	Medium level	Most likely level	Most level	Maximum level

1. Delivery guarantee for peak demand	1	2	3	4	5	6	7
2. Long-term incentive schemes for a high standard in product quality	1	2	3	4	5	6	7
3. Agreements on order changes	1	2	3	4	5	6	7

Joint decision making

Please indicate the extent to which your organization makes joint decision with your key suppliers.

Table 9

1	2	3	4	5	6	7
Not at all	Not very	Somewhat Infrequently	Neither Frequently Nor Infrequently	Somewhat Frequently	Frequently	Very frequently

1. Decisions on optimal order quantity	1	2	3	4	5	6	7
2. Decisions on new product developments or modifications	1	2	3	4	5	6	7
3. Decision on long-range planning	1	2	3	4	5	6	7
4. Decision on forecasting component requirements	1	2	3	4	5	6	7

Information quality

Please indicate the quality of the information that you have exchange with your key suppliers.

Table 10

1	2	3	4	5	6	7
Poor	Not very good	Fair	Average	Good	Very good	Excellent

1. The quality of the exchange information with your key suppliers regarding its relevance for your business requirements	1	2	3	4	5	6	7
2. The quality of the exchanged information with your key suppliers regarding its added value for your business requirements	1	2	3	4	5	6	7
3. The quality of the exchanged information with your key suppliers regarding it's up to date and timeliness.	1	2	3	4	5	6	7
4. The quality of the exchanged information with your key suppliers regarding its completeness.	1	2	3	4	5	6	7

Operational performance

Please rate the performance of your organization regarding the following operational indicators.

Table 11

1	2	3	4	5	6	7
Poor	Not very good	Fair	Average	Good	Very good	Excellent

1. Ordering cost	1	2	3	4	5	6	7
2. Quality and reliability of procured materials/components	1	2	3	4	5	6	7
3. Order cycle time	1	2	3	4	5	6	7
4. Ability to sense and respond to poor suppliers performance	1	2	3	4	5	6	7

Table 12: Representative list of supply chain relationship and integration constructs in the literature

Reference	Conceptualization of Buyer- Supplier Relationships	Main Results
Cannon and Perreault (1999)	Buyer-supplier relationships are manifested in information exchange, operational linkage, legal bonds, cooperative norms, adaptations by sellers and buyers.	Eight relationship types have been developed; each provides evidence of the diverse that buyers and suppliers conduct business.
Stank and his colleagues (2001)	Collaboration is defined as a process of decision making among interdependent parties which involves joint ownership of decisions and collective responsibility for outcomes	Results indicate that internal collaboration is associated with higher levels of logistical service performance whereas external collaboration does not.
Frohlich and Westbrook (2001)	Conceptualized supply chain integration through the direction (towards\ customers and/or suppliers) and extent of integration.	Results indicate that the higher the degree of integration with both suppliers and customers the higher the performance improvements.
Vickery and his colleagues (2003)	Supply chain integration is conceptualized through the practice that encompasses both intra-firm as well as inter-firm integration.	Supply chain integration positively affects customer service and indirectly financial performance through customer service.
Simatupang and Sridharan (2005)	Supply chain collaboration index is conceptualized through incentive alignment, information sharing and decision synchronization	Findings show that the collaboration index positively affects operational performance.
Vereecke and Muylle (2006)	Collaboration describes buyer- supplier relationships that embrace both conflict and partnership, employing some form of mutuality without an apparent need for lifetime commitment or total openness and trust	Collaboration only marginally improves rates of performance improvement. Information exchange improves performance in terms of cost, flexibility, quality and procurement indicators.